

no department of the science of mind does there prevail greater confusion and uncertainty than in that of Volition."

In the present volume Prof. Ach continues the records and results of his prolonged investigation into will-psychology; the former instalment being his 1905 treatise, "Über die Willenstätigkeit und das Denken." An account is given of the experimental method employed, which is largely a combination of those of Ebbinghaus and G. E. Müller. He employed eighteen subjects who were practised on reproduction of syllables, rhymes, and the like components of methods well known in laboratories.

As his main result, the author claims to have shown that the act of will is a specific psychic experience. The positive phenomenal characteristics of a primary volition are (1) the perceptive moment—sensations of tension; (2) the objective moment—ideas of reference and end, purpose, and means; (3) the actual moment—the acoustic—kinesthetic, "I will actually"; (4) conditional moment—consciousness of effort. Of these the chief is (3), and he explains why it has hitherto been so often ignored. None of these moments, of course, is independent; they are sides of one fact. Great spectacular results are not expected from the minute laboriousness of experiments like these; but they are latent, and, as Weber's Law, for instance, has done, will emerge in due time. Yet light is thrown on a score of "little problems." Not the least interesting, and the most detailed, discussion is that on weakness of will. A close study of this chapter in connection with the tabulated results of the investigation which occupy the first half of the volume would be a fruitful piece of book-work for the learner. Prof. Ach rightly censures the use of such examples, as the famous "How we get up in the morning" of Prof. James, for illustrating the mechanism of volition. Trained or habituated will is precisely that form of the process which is least original. Here, by the way, in the relation between habit and will—a relation of practical, no less than theoretical, importance—is a fruitful field for investigation. Another fruitful area is the connection between will and temperament. Prof. Ach ends his volume with a few suggestive pages on this subject.

The material supplied by the author's investigation is probably rich enough to yield further results if re-studied. So far, the author has been led towards a reaction against the prevailing view of will-processes. Without doubt this and similar work is clearing the ground for a new psychology, both of feeling and of will.

#### A BOOK OF CHARACTERISTIC FOSSILS.

*Leitfossilien: ein Hilfsbuch zum Bestimmen von Versteinerungen bei geologischen Arbeiten in der Sammlung und im Felde.* Lief. I.: Kambrium und Silur. By Prof. Georg Gürich. Pp. 95. (Berlin: Gebrüder Borntraeger, 1908.)

PROF. GEORG GÜRICH has prepared a well-illustrated handbook of characteristic fossils which is now in course of publication in eight parts. It is intended for elementary students and amateurs

who are occupied with geological work and desire an exact knowledge of those fossils which are of special value in determining the relative ages of rock-formations. It is not a treatise on common fossils, and those who seek in it an account of so familiar a brachiopod as *Atrypa reticularis*, for example, will be disappointed; but it deals with those species and genera which, whether common or not, happen to be restricted in their geological range, and are thus of service as unerring time-markers. The fossils of each successive period are taken in order, beginning with the earliest; and the twenty-eight plates included in the first part of the book are devoted to those of the Cambrian and Silurian formations. The figures are not original, but judiciously selected from standard works, and all are beautifully reproduced by a half-tone process. The accompanying text consists chiefly of brief definitions of the various groups, families, genera, and species, in systematic order under each geological formation. There are also useful synoptical tables, both of the formations themselves in different parts of the world and of the fossil species which are characteristic of each special stage. Occasional text-figures are added to explain structural features and the more important anatomical terms employed. In the first part, the figures illustrating the structure of trilobites and graptolites are especially good.

Dr. Gürich does not recognise an Ordovician system, but classifies the formations from the Tremadoc to the Caradoc inclusive as Lower Silurian. His work is also unusual among stratigraphical handbooks in paying special attention to fossil plants and vertebrates when they can reasonably be claimed as of value. His first reference to vertebrates, however, in the Upper Silurian is unfortunate, for it takes no account of Dr. Traquair's important discoveries, and repeats an old error in supposing that the shagreen named *Thelodus* belongs to the same fish as the fin-spines named *Onchus*. In view of present rapid progress and specialisation this oversight is not surprising, and Dr. Gürich is to be congratulated on having made an excellent beginning of a useful and trustworthy student's manual.

#### METALLOGRAPHY.

*Metallographie: Ein ausführliches Lehr- und Handbuch der Konstitution, und der physikalischen, chemischen und technischen Eigenschaften der Metalle und metallischen Legierungen.* Erster Band, Die Konstitution, Hefts. i. and ii. By Dr. W. Guertler. (Berlin: Gebrüder Borntraeger, 1909.)

THE number of investigations in metallography published up to 1902 amounted to about one thousand, but to-day reaches three times that number. This fact alone makes the appearance of a complete text-book on the subject most welcome.

The work is appearing in parts, the first two of which consist each of eighty imperial octavo pages, and it is expected that seven or eight more similar instalments will complete the first volume, which is devoted to the constitution of metallic alloys. A second volume, dealing with the physical and chemical properties of the alloys and with their technical applications is to follow.

The subject is to be treated from the technical as well as from the theoretical standpoint, and is to be made intelligible to a beginner without forfeiting its character of a complete text-book and work of reference.

Part i., after a short history of the development of metallography, deals with the "nature" of metallic alloys, the application of the phase-rule to the consideration of the various types of freezing of binary alloys, and also with solid solutions and chemical compounds of two metals. The remaining fourteen pages of the first part and half of part ii. deal with the "Zustandsdiagramme" of all the possible binary alloys of the metals manganese, iron, cobalt, nickel, copper, silver, gold, palladium, and the metals of the platinum-group. The second half of part ii. is devoted to internal kinetics, embracing such subjects as crystal growth and transformation, diffusion in metals, &c.

Whether all the objects aimed at will be achieved by the author cannot be predicted from a perusal of the first two instalments, but it may be safely asserted that a very promising beginning has been made on what can truly be described as a colossal task. The subjects already discussed are treated clearly and in a masterly style, and the arrangement (which is a matter of great importance in metallography) is excellent. The work will constitute the only complete text-book on the subject, and will undoubtedly rank as a classic.

#### EXERCISES IN PHYSICAL GEOGRAPHY.

(1) *Manual of Physical Geography.* By Dr. F. V. Emerson. Pp. xvii+291. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1909.) Price 6s. net.

(2) *A Laboratory Manual of Physical Geography.* By Prof. R. S. Tarr and O. D. von Engeln. Pp. xvii+362. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1910.) Price 6s.

(1) **T**HE purpose of the first of these books would have been made clearer if it had been entitled "Manual of Exercises in Physical Geography," for the 273 pages of which the body of the book is composed are almost entirely made up of questions and directions to students. The manual is divided into eighteen chapters, the first on the earth as a planet, the next four on climate and others on common minerals and rocks, on the contour map, on weathering streams and stream valleys (a long chapter, in which prominence is given to the cycle of erosion and all that that involves), on land forms (three chapters), on glaciation, lakes, the ocean, shore lines and forms, harbours, and soils, the final chapter being devoted to studies of typical areas.

Now there can be no doubt that teachers of the subject could hardly fail to get many a useful hint from an examination of this volume, but, on the other hand, it is scarcely conceivable that any teacher, at least in this country, would ever try to make use of it as it stands. For this there are several reasons. In the first place, the manual is not self-explanatory. Among the questions of which the bulk of the book is made up, some are childishly simple (though, it may be admitted, not without justi-

fication in the author's way of presenting his subject), others assume that the teacher is well versed in his subject, and has either already given the necessary explanations to his students or is prepared to do so when the student is required to answer them. Some of the questions are, unfortunately, confusing and misleading. Moreover, the teacher who is sufficiently well versed in his subject to be able to use the book will be too independent to submit his mind slavishly to the lead of another in presenting the subject to his class. The author says that the exercises have for the most part grown out of his class-room experiences, and it may fit in very well with the rest of the author's teaching of the subject, but it is not likely to fit in with the method of anyone else. Finally, the exercises set in this volume must involve the consumption of a great deal of time, and the doubt cannot but suggest itself whether the result in trained intelligence will be at all proportionate to the amount of time and labour expended.

(2) The work by Prof. Tarr and Mr. von Engeln is similar in design to that of Dr. Emerson, and its distinguishing features may be best given by the following extracts from the preface:—

"The feature which will first attract attention is the leaving of space after each question for the student to write the answer. This serves a double purpose. It ensures the student's following the argument of the outline and the appreciation of every point by personal observation and deduction . . .

"Another feature which we feel sure will meet with general approval is the insertion of all maps, figures, diagrams, and tables at the exact place where they are needed." (These maps, &c., it should be stated, are all likely to be very useful.)

The authors claim, moreover, as the most marked pedagogical departure in their manual, their orderly method of presenting the physiography of the lands. We may note further a feature which is likely to attract attention even before that just mentioned. The loose-leaf construction of the manual makes it a very simple matter for the teacher to change the order or introduce other work. The pages are all perforated to allow of their being detached, and pierced with two large holes to allow of their being refixed in another arrangement, this being done because

"the authors feel that teachers who are progressive, capable, and enthusiastic over the subject should be given the greatest latitude in carrying out their own ideas."

Finally, with reference to the present reviewer's remark at the end of his notice of Dr. Emerson's work, it is only fair to say that the methods of this manual,

"are not to be regarded as experiments. The senior author has had over fifteen years' experience and the junior author four in the laboratory teaching of physical geography."

They tell us, too, that the results in their own classes have been very gratifying, and that the students pursue the work with keen interest. The reviewer, therefore, would have his "doubt" taken as no more than a doubt, and he is sure that such systematic efforts towards the improvement of teaching are entitled to sympathetic consideration. G. G. C.